

# **State of Michigan Rebuild Michigan**

## **Technical Energy Analysis Guidelines**

**Prepared By:**

**Michigan Department of Labor & Economic Growth  
Energy Office**

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This guide is a reference for energy analysts who will be preparing Technical Energy Analysis (TEA) reports for participants in the Rebuild Michigan Program. Technical questions regarding these guidelines should be addressed to the staff engineer at the Michigan Energy Office.

## **Part I: Overview**

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### **A. Program Description**

Rebuild Michigan assists Michigan public schools, colleges/universities, local governments and public multi-family housing with enhancing the energy efficiency and management of their buildings. The Energy Office assists with coordinating the major steps in completing successful energy-saving capital improvement projects, including project identification and implementation, monitoring, and troubleshooting. Utility bill savings realized as a result of implementing these projects can be used to make payments on project financing.

Participants in Rebuild Michigan receive a preliminary walk-through of their building(s) to assess potential for energy savings. From this walk-through, an introductory energy evaluation (IEE) report is prepared to offer the participant examples of energy saving measures that are possible. The results of the IEE become the basis for the Energy Office to recommend and the participant to decide whether to proceed with a Comprehensive TEA or a Limited Component TEA, as hereafter defined. The next step of this process is for the participant to choose a TEA analyst from the Energy Office pre-qualified list to perform an in-depth energy analysis. A completed TEA report will provide the participant with recommended energy conservation measures (ECMs) and operation and maintenance changes (O&Ms), along with related detailed engineering and cost savings calculations. The Energy Office provides the participant with an engineering review of the report to verify accuracy and assure compliance with the TEA guidelines. The approved report will be presented to the client as the basis for developing a project implementation plan. Financing of the energy project is available from the Michigan Municipal Bond Authority (MMBA), which will work with the participant to obtain funding. After project implementation, the Energy Office continues to assist the participant by offering savings monitoring and troubleshooting.

### **B. Eligibility for Participation**

Rebuild Michigan is available statewide to all public schools, colleges/universities, local governments and public multi-family housing authorities.

Each participant may select up to 10 buildings to be evaluated for energy performance. The buildings must be no less than 25,000 ft<sup>2</sup>, combined gross square footage, and no more than 750,000ft<sup>2</sup>. The participant is encouraged to include additional buildings in the TEA and implementation stages of the project.

## **C. Program Elements**

### **1. Technical Energy Analysis (TEA)**

Subsequent to receiving the Introductory Energy Evaluation, the Energy Office will recommend that a participant contract with a pre-qualified energy analyst to complete a TEA report. The TEA report will either be a Comprehensive TEA or a Limited Component TEA, depending on the complexity of the building(s) and the ECMs recommended. The TEA report will receive an assurance review by an Energy Office engineer and subsequent approval if it meets the requirements set forth. If the TEA report falls short of guideline requirements, the Energy Office engineer will work with the analyst to finalize a report so that it meets the requirements, ensures that energy savings projections are accurate and recommends ECMs that are feasible.

### **2. Project Financing and Implementation**

The participant is now prepared to obtain contract bids to purchase and install the O&Ms and ECMs recommended in the TEA report. The project may be financed in whatever way is most advantageous to the client. One option is to obtain financing through the Michigan Municipal Bond Authority (MMBA). MMBA is a nonprofit agency established to provide public institutions with cost effective choices for borrowing funds. MMBA has two programs available that can be used to finance energy efficiency projects; the Local Government Loan Program and the Local Government Financing Program. Both programs are available for public schools, colleges, universities and local governments. For more information contact MMBA at (517) 373-1728.

### **3. Energy Use Monitoring and Troubleshooting**

Upon request the participant's energy usage can be monitored for 12 months after installation of the O&Ms/ECMs, which were recommended by the TEA report. An experienced Energy Office engineer or contractor will perform monitoring. Additionally, the Energy Office engineer will assist the participant's efforts to troubleshoot the project in the event that predicted energy savings are not realized during the first year monitoring period.

## **D. The Pre-Qualified TEA Analyst**

All TEA reports submitted under Rebuild Michigan must be completed by a pre-qualified TEA analyst. To qualify as a pre-qualified analyst, the analyst must:

- be licensed in Michigan as a professional engineer or architect in the state of Michigan
- have experience working with all aspects of building energy systems
- participate in the annual Energy Office-sponsored TEA workshop, to keep abreast of program changes and available energy efficient technologies and strategies.

## **Part II: The TEA**

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**This section describes the minimum requirements for the comprehensive TEA and the Limited Component TEA. Qualified TEA analysts need not restrict their professional creativity to these requirements but may insert additional sections anywhere in the TEA.**

### **A. Comprehensive TEA & Limited Component TEA**

Two levels of TEAs are available to participants: the Comprehensive TEA and an abridged “Limited Component TEA.” These analyses will differ by the type(s) of ECMs recommended by the analyst, and the complexity of the building(s) being evaluated. The general reporting requirements, that follow, will remain essentially the same for both types of TEA.

The Comprehensive TEA will include all aspects of a normal technical energy analysis of the building envelope, heating systems, mechanical cooling systems, domestic hot water (DHW) systems, lighting, plug loads, and energy management system (EMS).

In order to offer participants a cost-effective study for buildings which may not require a full energy analysis, the Limited Component TEA is being offered. The Limited Component TEA will be limited to simpler measures such as lighting, simple hvac controls and improvements (mechanical timers, night setback controls, programmable controllers, boiler outdoor reset controls, new boiler burners, etc.), automated lighting controls and same-size furnace or motor replacement. ECMs and O&Ms analyzed in the Limited Component TEA will not require computer modeling of the building. They are to be analyzed using simpler yet proven methods to make the Limited Component TEA more cost-effective to those program participants.

### **B. Objectives of the TEA**

The intent of a TEA report is to:

1. Provide the participant with sufficient, detailed information to make an informed decision as to which O&Ms and ECMs to finance for installation in their building(s). In the process, identify all feasible O&Ms and ECMs for the participant’s facility, depending on the individual requirements for the Comprehensive TEA or Limited Component TEA. The energy savings and cost information contained in the TEA report should be sufficient for the participant to confirm the economic merit of the proposed ECMs.
2. Identify all feasible no/low-cost energy saving O&Ms. Sufficient information should be provided for the participant’s operational staff to implement these O&Ms.
3. Provide Energy Office engineer with sufficient information to review and approve the TEA report and verify savings calculations.
4. Provide calculated baseline data against which future energy use can be compared.

A clear and thorough description of each feasible O&M and ECM recommended for financing must be presented in the report. Each description must include sufficient information to allow engineering personnel other than the TEA analyst to assist in preparation of specifications for bid documents.

### **C. General Format Requirements for the TEA Report**

#### **1. Formatting the TEA Report**

All pages of the report must be numbered to allow for easy reference. All charts and tables must include descriptive titles and an identifying number or letter. The report should be clear, concise and well-documented.

#### **2. Submitting the TEA Report**

The completed TEA Report should be submitted to the Energy Office with all required information to the address Listed Below:

##### **Via shipping Method (UPS or FED EX)**

Tim Shireman  
Energy Office – Ottawa Building 4<sup>th</sup> Floor  
611 W Ottawa  
Lansing, MI 48933

##### **Via US Postal Service**

Tim Shireman  
Energy Office – Ottawa Building 4<sup>th</sup> Floor  
PO BOX 30221  
Lansing, MI 48909

### **D. Required TEA Report Sections**

Each of the following sections is required in the TEA report. The recommended order of sections, as presented in the report, follows. However, additional sections may be added to make it more descriptive for the participant, Energy Office and potential lenders. Section dividers with labeled tabs are encouraged to make the TEA report easier to review.

#### **1. Cover**

The title page must include the following information:

- The words “Rebuild Michigan Comprehensive Technical Energy Analysis Report” or “Rebuild Michigan Limited Component Technical Energy Analysis Report”
- The participant’s (client’s) name
- The name and address of the building(s) analyzed in the TEA report
- The name, phone number, and address of the analyst who produced the TEA report
- The date of the TEA report

2. Table of Contents

The Table of Contents must be complete with page numbers and a descriptive title for each required section of the TEA report.

3. TEA Analyst Certification/Disclosure

The *TEA Report Certification* form (**Appendix A**) must be completed by a pre-qualified TEA analyst and included in the report with an **original** signature of the analyst.

4. Executive Summary

The contents of this section are left to the discretion of the TEA analyst. The exception is:

A summary table of all identified O&Ms and ECMs recommended for financing must be provided for each building. The sample form, *O&Ms and ECMs Summary Form* (**Appendix B**), illustrates the information to be included in the summary table mentioned above.

The following are **suggested items** for inclusion in the executive summary of the TEA report.

- A brief description of the Rebuild Michigan Program such as:

“This report is submitted in accordance with the Rebuild Michigan Program. Rebuild Michigan, managed by the Michigan Department of Labor and Economic Growth, Energy Office, is designed to assist public schools, colleges/universities, local governments and public multi-family housing with implementing energy efficiency projects in their buildings. Utility bill savings realized from implementing O&Ms and ECMs identified in this report can cover the cost of ECM financing. Rebuild Michigan provides information on project financing options and direct technical assistance before and after installation.”
- A discussion of the participant’s total annual energy costs and how these costs can be reduced by the installation of O&Ms/ECMs.
- A discussion of the O&Ms/ECMs selected by the TEA analyst, the associated costs of installing these O&Ms/ECMs, and the projected savings and simple payback.

5. Building Description/Characteristics

This section calls for a description of the building(s) and information about building occupancy, construction and energy systems in sufficient detail that an Energy Office engineer can verify the estimated energy savings for the targeted O&Ms/ECMs, including operating characteristics of energy-using systems. The building description must also contain the square footage of the building. Items that should be considered for discussion include the following:

**BUILDING PLANS -**

A floor plan of each building level (identical levels may be depicted by a single plan) -- square footage of original building and additions; year(s) of construction, including additions.

**OCCUPANCY PATTERNS -**

Current number of occupants; annual operating hours; weekday operating schedule; setback temperatures and schedules.

**BUILDING ENVELOPE -**

Exterior walls (materials, condition, R/U values); windows (condition, R/U values); roof (materials, condition, R/U values); estimated remaining useful building life; special use areas (gyms, auditoriums, laundries, computer rooms, kitchens, workshops, swimming pools, other areas).

**MECHANICAL & ELECTRICAL SYSTEMS -**

Heating system (control system, fuel options, load conditions, distribution system, rated or



measured combustion efficiency); cooling system (control system, cooling rating in tons, distribution system); air handling system (control system, operating schedule); DHW system (control system, set temperature, circulation equipment, tank insulation); lighting (fixture & lamp type, control system); EMS (brand name, age and operating characteristics).

6. Building Fuel Cost Information

Fuel cost/consumption data, representative of usage under existing building conditions, must be provided for the most recently available twelve-month period. The recommended format is illustrated by the *Building Fuel Cost/Consumption* form (**Appendix C-1** and **C-2**). Annual energy use and cost data should be calculated for each fuel type. Copies of fuel bills for the 12-month period must be supplied to support the *Building Fuel Cost/Consumption* forms. “Customer demand” charges and power factor charges for electricity should be included in calculating average electricity rates. If ECMs are recommended to reduce demand or power factor charges, these charges should be set apart in a separate column and totaled. The average fuel rates calculated on the *Building Fuel Cost/Consumption* forms should be used in ECM savings calculations unless a different rate can be justified (e.g., prospective switch to a different utility supplier).

If two or more buildings are supplied with energy through a single meter, allocate the fuel use of each building in a manner that can be logically justified and describe how the allocations were calculated.

7. Energy Use Profile (not required for Limited Component TEA)

An energy use profile for each building is required for each fuel for which savings are claimed. A suggested format for reporting the fuel use profile is provided in the *Energy Use Profile* form (**Appendix D**). The energy use profile breaks down specific fuel use in each building to predict the building’s annual baseline energy consumption and to analyze ECMs. The profile is created through a building energy load analysis which determines the percentage of fuel that is consumed by various load categories (e.g., lights, motors, chillers, office equipment, laundry, etc.). The estimated loads should approximately equal the annual fuel consumption found in the utility bill analysis. Any significant discrepancies should be discussed in the TEA report.

8. No/Low-Cost O&Ms

Recommending general O&M changes in the TEA report will not only result in energy savings but will directly impact the effectiveness of any ECMs recommended for financing. The TEA shall identify two types of O&M changes. The first type shall be no or low-cost O&Ms which can be readily implemented by facility personnel. These O&Ms should be operational and maintenance changes that offer short or immediate payback. The TEA report should contain a list of recommended no/low-cost O&Ms, including a clear and detailed description of each measure identified. No/low-cost O&Ms that are to be implemented by in-house staff must provide sufficient detail for the facility's maintenance staff to perform the work.

The second type of O&Ms to be addressed by the TEA report shall be O&Ms that require financing. Under Rebuild Michigan, O&Ms can be financed in the same implementation package as ECMs. Examples of financeable O&Ms are: steam trap replacement, pipe insulation, replacing inoperative thermostats, and refurbishing outside air dampers and controls. To be financed under the program, these O&Ms will require cost and savings analysis and shall be analyzed as described below. There is no minimum payback time for O&Ms which require financing.

9. Analysis of O&Ms/ECMs

The following guidelines must be observed in the analysis and presentation of O&Ms and ECMs chosen for financing in the TEA report:

a. **Required O&M/ECM Types -- Comprehensive TEA**

Each of the following four major areas must be addressed in the full TEA report (for Limited Component TEA, see 9.b, below). If one of the four major areas has no O&M or ECM recommendations, the TEA report must contain a statement explaining the exclusion.

<b>BUILDING ENVELOPE-</b>	e.g. storm windows; reduction in window area; roof/ceiling insulation; weather stripping
<b>DOMESTIC HOT WATER -</b>	e.g. insulation of tanks/piping; temperature controls; flow restrictors; replacement of DHW system
<b>HVAC / CONTROLS -</b>	e.g. replacement of boilers; combustion controls; boiler and pipe insulation; steam trap repair or replacement; duct insulation; system conversions; chiller modifications; automatic controls or energy management system
<b>LIGHTING -</b>	e.g. conversion to T-8 fluorescent lamps; conversion from incandescent to compact fluorescent; automated HID or fluorescent lighting controls

b. **Required O&M/ECM Types -- Limited Component TEA**

The areas of ECM analysis for the Limited Component TEA report are limited to the following:

<b>HVAC -</b>	e.g. modulating burners; same-size replacement of furnaces or motors; simple hvac controls, such as mechanical timers or stand-alone programmable controllers; outdoor air reset controls; duct or pipe insulation
<b>LIGHTING -</b>	e.g. conversion to T-8 fluorescent lamps; conversion from incandescent to compact fluorescent; automated controls

Recommended O&Ms that are to be financed through the Rebuild Michigan Program can be taken from any of the four major areas listed under the TEA requirements.

**c. Allowable Paybacks**

To be considered for financing under Rebuild Michigan, the aggregated simple payback of O&Ms and ECMs chosen must be 8 years or less.

**d. ECM Detailed Description Form (Required)**

Each recommended ECM must include a detailed narrative description providing:

- a clear and thorough description of the existing conditions and the proposed ECM.
- quantity, type and location of all equipment or building components involved in each ECM.
- details concerning how and where the utility savings are expected to occur.

The TEA analyst must verify that all proposed building changes meet or exceed local and state building codes.

An *ECM Detailed Description Form* must be provided for each measure. The required format is provided in **Appendix E**. The pre-installation and post-installation conditions for each ECM should include information about the quantity, size, type and location of the equipment involved (e.g., pre-installation: twelve 150-watt incandescent suspended fixtures in classroom 5B; post-installation: twelve 2-lamp F32T8/electronic ballast suspended fixtures in classroom 5B). Fuel unit costs must match those provided in the *Building Fuel Cost Information and Energy Use Profile* section of the TEA report.

The *Detailed Description Form* for each ECM must also include the following:

- the estimated useful life and salvage value or disposal cost.
- estimated annual dollar savings and energy savings.
- the calculated simple payback.
- the total cost, as listed on the *Cost Estimating Worksheet* (Appendix F).
- a list of all O&Ms or ECMs that interact with the proposed ECM.

**e. Interactions between ECMs (not required in Limited Component TEA)**

When energy savings are being determined for more than one ECM, interaction between the O&Ms and ECMs selected for implementation must be accounted for in the TEA report. Interaction between ECMs can reduce the savings of one measure due to the effect from another. For example, adding insulation to the building envelope reduces the savings associated with the installation of a high efficiency boiler because the heating requirements are reduced by the added insulation. The calculations to account for the interaction must be shown and clearly labeled. If interaction between two ECMs is negligible, a statement must

be made that says interaction has been considered and the effect of interaction upon the predicted energy savings is negligible.

The order of presentation of the ECMs is left to the discretion of the TEA analyst. However, the TEA analyst should present the ECMs in an order that reflects their interactions with each other. This will result in the savings calculations for a particular ECM being based on building conditions after all lower-numbered ECMs are implemented.

**f. Cost Estimating Worksheet (Required)**

A *Cost Estimating Worksheet* will be required for each recommended ECM (see **Appendix F**). Costs for material acquisition, installation and design (if any) should be included. The source of the cost estimate must be cited. Include the source title and publication year (eg., “Means Mechanical 2004”). If available, include copies of quotations. The estimated useful life of each ECM and an estimate of any salvage value or disposal cost must also be included.

**g. Savings Calculations**

Savings calculations must be presented in a clear and precise manner for each ECM. If manual calculations or spreadsheets are used, the formula(s) used to estimate the savings for each ECM must be provided, **along with the units**. Formula input parameters must be clearly identified and labeled. All assumptions critical to the calculations must be clearly identified and justified.

*The information provided in a TEA report must be adequate for an Energy Office engineer to confidently verify the energy savings of each ECM.*

The fuel unit costs in the calculations must match those provided in the *Building Fuel Cost Information* section of the TEA report. If fuel unit costs are time-of-day dependent, the calculations should include on-peak and off-peak savings. Electrical energy savings in kWh and demand savings in kW should be calculated separately. If kW demand savings are claimed, the calculations must demonstrate the extent to which the equipment in question contributes to the peak demand.

Calculation details and supporting documentation may be placed in an appendix at the analyst’s discretion. TEA analysts are encouraged to include reference materials in the TEA report.

**h. Variable-Base Degree Day Method vs. Bin Method**

The 65E base degree day method for energy analysis is not acceptable due to its limitations in accounting for internal gains. Either the variable-base degree day method or modified bin method should be used for savings calculations. The variable-base degree day method is acceptable for relatively inexpensive and straightforward projects. Calculations for the balance point temperature should be provided. The modified bin method is recommended for more complex projects. For manual calculations, include a description of the location/equipment and periods under consideration with every use of the bin method (eg., existing conditions for AHU#3, occupied hours: Sept. 15 - April 15).

**i. Computer Models**

Frequently, calculations performed by hand or with a simple computer spreadsheet are sufficient to accurately predict the utility savings associated with an ECM. Computer modeling may be more useful than hand calculations for complicated projects. The following computer software programs have been pre-approved by the Energy Office for use in preparing TEA reports for Rebuild Michigan:

- A Simplified Energy Analysis Method (ASEAM)
- Building Load Analysis and System Thermodynamics (BLAST)
- Carrier E 20 II
- DOE-2
- Trane Air-Conditioning Economics (TRACE)

If computer modeling is employed, the model and each set of results must be properly documented. The minimum documentation required in a TEA report is:

- the name and version of the program.
- a table that shows the model's calculation of the building's energy consumption for a summer month and a winter month of the base year versus the actual consumption.
- a clear presentation and justification, for each ECM, of the input parameters used to model the post-installation conditions.
- an output summary for each ECM that provides a clear presentation of the results of the computer analysis.

The input data for the building and for each ECM must be presented in a clear and precise manner. The base run output data must match the actual data within 10%. Explanation of all codes and abbreviations must be provided so that all input and output data is clear and meaningful.

For modeling ECM savings, any changes made to the input parameters for the purpose of interaction must be identified. Evidence must be provided to verify that interaction was taken into account. An Energy Office engineer may require verification of the results of the computer modeling.

### Part III: Review of the TEA Report

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#### A. TEA Report Review Process

The purpose of the Energy Office's review of TEA reports is to provide program participants with an independent technical review of the recommendations and energy-savings predictions that are presented in the reports. ***Prior to the participant receiving their copy of the TEA report from the analyst, the analyst must submit the TEA report to the Energy Office for its review.*** A solid TEA report that can support ECM financing is the final objective of this review. An Energy Office engineer leads the technical portion of the review process. During the review, the Energy Office engineer may require further justification or clarification of information contained in the report. If so, the Energy Office engineer will communicate with the analyst regarding these TEA report issues. Based on this communication, it may be necessary for the TEA analyst to revise or amend the report. It is the responsibility of the TEA analyst to ensure that the Energy Office and the program participant receive clean, final TEA reports that include all revisions and amendments. Original, revised pages must be provided to the Energy Office. All revised TEA reports must receive a final review by the Energy Office engineer prior to submission of the original report to the program participant.

#### B. TEA REPORT QUALITY SCORE

It is important that Rebuild Michigan Energy Services maintains a high level of quality control on TEA reports. The measure of the quality of a TEA report is the value that the report provides to the participant; in particular, the accuracy of the utility savings predicted. The tool Energy Office uses to maintain the quality of TEA reports is "TEA scoring." The TEA reports are scored, and scores are made available to interested parties. The scoring criteria are objective and meant to help the TEA analyst produce a clear, concise TEA report. The *TEA Report Score Sheet* can be found in **Appendix G**. There are a total of 100 points possible for the TEA report. Full points are awarded for criteria that are fully met. Criteria that are not met may receive partial or full deductions.

<b><i>A poorly constructed and written report may jeopardize an analyst's future participation in the Rebuild Michigan Program. TEA analysts who submit two consecutive TEA reports that each receive a score of less than 75 points will be disqualified for one year.</i></b>
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**Part IV: Appendices**

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**Please see attached  
packet or file**

**APPENDICES**

Sample forms for Rebuild Michigan TEA Reports

APPENDIX A	<i>TEA Report Certification</i>
APPENDIX B	<i>ECM Summary Form</i>
APPENDIX C-1	<i>Building Fuel Cost/Consumption Form – Gas</i>
APPENDIX C-2	<i>Building Fuel Cost/Consumption Form – Electricity</i>
APPENDIX D	<i>Building Energy Use Profile</i>
APPENDIX E	<i>ECM Detailed Description Form</i>
APPENDIX F	<i>Cost Estimating Worksheet</i>
APPENDIX G	<i>TEA Report Score Sheet</i>
APPENDIX H	<i>Glossary of Abbreviations</i>



# APPENDIX A - TECHNICAL ENERGY ANALYSIS (TEA) REPORT CERTIFICATION FORM

I am a Professional Engineer or Professional Architect registered with the State of Michigan, and:

- X I have performed technical energy analyses (TEAs) in (# of)\_\_\_\_\_ institutional buildings.
- X I have either performed all of the work associated with the production of the report identified on this form or have supervised the work of others who produced the report.
- X The report identified on this form meets the program guidelines as described in the document entitled Rebuild Michigan TEA Guidelines and is accurate to the best of my belief and knowledge.
- X All recommendations in the report identified on this form comply with the appropriate local, state and federal codes and standards for this type of facility.
- X I and/or the company that employs me will potentially benefit financially by the implementation of the recommendations that are made in the report in the following categories:

\_\_\_ Contract Negotiation \_\_\_ Engineering/Design \_\_\_ Installation

\_\_\_ Other (specify): \_\_\_\_\_

Please provide all information requested in the following table.

TEA Analyst Name (Printed)	
Professional Registration #	
TEA Analyst Signature	
TEA Analyst Phone #	
TEA Analyst=s Company	
Company Address	
Company City, State, Zip	
TEA Report Name	
Building(s) Studied in TEA Report	

## APPENDIX B - ECM Summary Form

TEA Report  Ref. Page	Check if Selected for Financing	ECM Descriptive Name	Estimated Project Cost (\$)	Energy Cost Savings (\$/yr)	Simple Payback Period (yrs)	Estimated Life (yrs)
Column Totals:						Average Payback

Client (Program Participant):

Building:

# APPENDIX C-1 - Building Fuel Cost/Consumption Form - Natural Gas/Other Heating Fuels

Month/ year	Consumption / Units: _____ (MCF/CCF/GAL)	Unit Cost (Commodity Charge)	Transportation Cost	Miscellaneous Fees (customer service charge)	Total Fuel Cost
Totals:					

Client:

Building:

Utility Company:

Service Type:

Building Area:

Average Unit Cost:

Total Energy Use:

Energy Utilization  
Index (EUI):

Cost per sq.ft./year:

## APPENDIX C-2 - Building Electricity Cost/Consumption Form

[illegible]

Client:	
Building:	
Utility Company:	

Building Area:	
Average Unit Cost:	
Fuel Consumption:	
Energy Utilization Index (EUI):	

Cost per sq.ft/year:

## APPENDIX D - Building Energy Use Profile

Electricity	Annual Consumption kWh	Annual Cost	% of Energy Use
Lighting			
Fans & Pumps			
Domestic Hot Water			
Office Equipment			
Cooling			
Column Totals			100%

Fuel Type: _____ (Gas / Oil)	Annual Consumption Units: _____	Annual Cost	% of Energy Use
Heating			
Domestic Hot Water			
Column Totals			100%

Client:

Building:

## APPENDIX E - ECM Detailed Description Form

ECM Name / Number / TEA Report Ref. Page:

**Client Name:**

Description of pre-installation conditions (use additional pages if necessary):

Description of post-installation conditions (use additional pages if necessary) :

1. What is the estimated increase or decrease in annual operating or maintenance costs after implementation of this ECM?

\_\_\_\_\_  
\_\_\_\_\_

2. What is the estimated useful life, in years, of the equipment to be installed under this ECM?

\_\_\_\_\_

3. What is the estimated salvage value of the equipment to be installed under this ECM?

\_\_\_\_\_

4. Indicate the ID number, name or TEA page number of those O&Ms or ECMs that interact with this proposed ECM.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. Indicate the estimated annual energy savings in BTUs for this ECM.

\_\_\_\_\_

6. Indicate the estimated annual energy cost savings in dollars for this ECM.

\_\_\_\_\_

7. Indicate the TEA report page number(s) for assumptions, parameters, formulas, costs, and calculations for this ECM.

\_\_\_\_\_

8. List the total cost for this ECM as it appears in the *Cost Estimating Worksheet*.

\_\_\_\_\_

9. What is the payback for this ECM?

\_\_\_\_\_

APPENDIX F - Individual ECM Cost Estimating Worksheet

ECM Name:

Description of Item/Source of Cost Estimates	Acquisition Cost (\$)	Installation Cost (\$)	Design Cost (\$) <i>[if any]</i>	Total Cost (\$)	Estimated Disposal Cost	Estimated Life
Column Totals						

Client:

Building:

# APPENDIX G - TEA Report Score Sheet

page 1 of 2

REQUIREMENT	Pts	Points Deducted	TEA Report Ref
<b>Administrative Review</b>			
TEA Report was submitted to the Energy Office within a timely manner	2		
All required information is included on the TEA report cover page.	2		
The TEA Report Certification Form is properly completed and signed.	4		
All required information is included in the TEA report Table of Contents.	1		
All required sections are included in the TEA report.	5		
All TEA report pages are legible and numbered, including appendices.	1		

<b>Technical Review</b>			
All required information is included in the Executive Summary ECM Summary Sheet.	3		
All necessary building description information is included.	5		
All necessary building energy use information is included in the building fuel consumption form.	3		
Energy use profile is included.	3		
Fuel cost information is correctly calculated.	5		
Copies of the appropriate utility bills are provided with the TEA report.	3		
Fuel costs agree with the costs identified in the Building Fuel Consumption form.	3		
All tables, charts, drawings, etc. are numbered and properly documented.	3		
No/low-cost O&Ms are satisfactorily addressed.	3		
All required O&M/ECM areas have been satisfactorily addressed.	5		
Documentation of efficiency and/or power ratings is adequate.	3		
Hours of equipment/space use are specified.	3		



# APPENDIX G - TEA Report Score Sheet

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REQUIREMENT	Pts	Points Deducted	TEA Report Ref
<b>Required Detail Description form is included and includes the following two items:</b>			
The descriptions are adequate to fully understand each O&M/ECM.	6		
All interaction effects relative to O&Ms/ECMs are correctly considered.	6		
<b>Required Cost Estimating Worksheet is included for each measure and contains the following items:</b>			
Complete Cost estimates are included	6		
Source of cost estimates are identified	6		
<b>Calculations include the following required items:</b>			
All assumptions and parameters are clearly stated and are reasonable.	6		
All arithmetic and math and/or computer modeling is correct.	10		
Pre-approved software was used in any computer models.	3		
Column Totals:	100		
Total Score:			

## Savings Summary:

Estimated BTU Savings: \_\_\_\_\_ Estimated Dollar Savings: \_\_\_\_\_

Estimated Project Cost: \_\_\_\_\_ Simple Payback: \_\_\_\_\_

Name of Program Participant: \_\_\_\_\_

Building(s): \_\_\_\_\_

Date TEA Report Received by the Energy Office: \_\_\_\_\_

Date Administrative Review Completed (& initial): \_\_\_\_\_

Date Technical Review Completed (& initial): \_\_\_\_\_

Date Participant Notified by the Energy Office: \_\_\_\_\_

## **APPENDIX H - Glossary of Abbreviations**

TEA	Technical Energy Analysis - Engineering study conducted by pre-qualified engineering firm.
ECM	Energy conservation measure
IEE	Introductory Energy Evaluation - Walk through feasibility study of a program client conducted by the Energy Office engineer or Rebuild Michigan Energy Services contractor.
MMBA	Michigan Municipal Bond Authority - Offers low interest financing to public entities for energy efficiency projects.